Laboratory Maintenance Management Program

Los Alamos National Laboratory
Laboratory Implementation Requirement LIR 230-04-01.1
Issue Date: 4/28/98 (Revised 6/29/01) **MANDATORY DOCUMENT**

1.0 Introduction

1.01 Lessons Learned Note: *Click here* for Lessons Learned that may apply to the requirements contained in this LIR.

The requirements for the LANL maintenance management program are defined in LPR 230-01-00, Managing Facility Assets; LPR 230-02-00, Facility Condition and Inspections; LPR 230-03-00, Maintenance Work Control; LPR 230-04-00, Conduct of Maintenance; LPR 230-05-00, Preventive Maintenance; LPR 230-06-00, Maintenance Procedures and Documentation; LPR 230-07-00, Maintenance History; and LPR 230-09-00, Inventory and Categorization of Facilities. LPR 230-09-00, Inventory and Categorization of Facilities identifies the requirement for categorization of Structures, Systems, and Components, (SSC). LIG 230-09-01, Developing Graded Master Equipment Lists provides guidance for assigning SSC to categories of importance based on consequence of failure.

This document provides the requirements for the maintenance of SSC assigned to the various categories of importance and milestones for implementing a Laboratory-wide maintenance program. The implementation milestones and detailed requirements that shall be met are presented in Attachments 1 and 2. This document replaces PRD121-01, Maintenance Management, and LS121-02, Graded Approach to the Conduct of Maintenance. The contents of this document are effective upon the issue date.

2.0 Purpose

The purpose of this LIR is to document and communicate the requirements for maintenance of LANL managed property. The requirements for the level of rigor and formality that shall be applied to SSC within the four categories of importance are defined.

3.0 Scope and Applicability

The maintenance requirements outlined in this document shall apply to all Laboratory property, both real and personal and to all buildings. However, office furniture, office equipment, and personal computers are categorically excluded from the requirements of this document. For all other SSC the amount and the formality of the maintenance, shall be determined based on the graded approach. Items with the potential to impact public safety, worker safety, or the environment shall be subject to a rigorous maintenance program. Items with minimal impact may simply be repaired as needed, but they must be categorized, via the graded approach, to determine the level of maintenance required. In addition to this, designated nuclear facilities are required to comply with the DOE Order 4330.4B, Chapter II. The specific areas of compliance are specified in an Institutional Maintenance Implementation Plan (MIP) and facility specific MFPs.

4.0 Definitions

4.1 Terms

corrective maintenance-The repair and restoration of equipment or components that have failed or are malfunctioning and are not performing their intended function.

graded approach-The selective and judicious assignment of resources to the maintenance of systems and components based on their level of risk. Systems and components shall be assigned to one of four categories based on the potential impact of a worst case failure on public safety, worker safety, the environment, safeguards and security, and the programmatic mission. The categories are identified as 1, 2, 3, or 4, with 1 representing the highest level of importance and requiring the most rigorous level of maintenance and 4 representing the lowest level of importance and requiring no formalized maintenance program. LIR 230-01-02, Graded Approach for Facility Work, provides a detailed explanation of the categories and their application.

graded approach categories:

Category ML1-The failure of the structure, system, or component may cause the death or serious (disabling) injury or illness of a member of the public, or may cause severe damage to the environment beyond the boundaries of the Laboratory.

Category ML2 - The failure of the structure, system, or component may cause minor injury, illness, irritation, or annoyance to a member of the public, may cause death or serious (disabling) injury or illness of a Laboratory worker, may cause damage to the environment within the Laboratory boundaries, may allow loss or theft of Category I quantities of Special Nuclear Material (SNM) or national security information, may cause the total loss of the use of a facility or major process, or may have a severe mission or economic impact.

Category ML3 - The failure of the structure, system, or component would have no impact on the public, but it may cause minor injury or illness of a Laboratory worker, may cause damage to the environment limited to the immediate area around the facility, may allow loss or theft of Category II or III quantities of SNM or classified information, or may cause damage to a facility or process or have a serious mission or economic impact.

Category ML4 - The failure of the structure, system, or component would have no probable impact on the public, Laboratory workers, the environment,

or safeguard and security concerns, but it may cause minor damage to a facility or process resulting in mission interruption or inconvenience.

maintenance-The sum of the activities, both preventive and corrective, that is intended to restore and preserve the value or function of an asset.

Master Equipment List (MEL)-A detailed list of the equipment, components, and structures to be included in the maintenance program. LIG 230-09-01, Developing Graded Master Equipment Lists, provides guidance as to the items to include in the list.

Personal Property and Programmatic Equipment (PP&PE)-Equipment used purely for programmatic purposes, such as reactors, accelerator machinery, chemical processing lines, lasers, computers, machine tools, etc., and the support equipment dedicated to the programmatic purpose. This property/equipment is also referred to as organizational, research, production, operating or process and was formerly known as Class B.

post maintenance testing-The means of verifying that assets meet current operating requirements prior to returning the asset to service following preventive or corrective maintenance. The testing process should confirm that the original deficiency has been corrected in the case of corrective maintenance, that no new deficiencies have been created, and that the equipment is ready to return to service.

preventive maintenance-The planned maintenance activities that are intended to maintain a piece of equipment within design operating conditions and to extend its service life which are performed prior to equipment failure. Preventive maintenance includes predictive, periodic and planned preventive maintenance activities. Predictive maintenance involves monitoring and trending of equipment operating parameters to predict failure. Periodic maintenance involves action taken on a routine basis such as lubrication, cleaning, testing, adjusting, and inspection. Planned preventive maintenance includes those nonroutine actions initiated as a result of predictive or periodic maintenance to replace components prior to failure.

Real Property and Installed Equipment (RP&IE)-The land, improvements on the land such as buildings, roads, fences, bridges, and utility systems and the equipment installed as part of the basic building construction that is essential to normal functioning of a building space, such as plumbing, electrical and mechanical systems. This property/equipment is also referred to as institutional or plant and was formerly known as Class A.

5.0 Responsibilities

5.1 Division Directors-The owning Division Director shall have ultimate responsibility for the maintenance of the assigned real property and personal property. The Division Director must delegate and communicate the responsibilities and appropriate authorities to Facility Managers for the maintenance of real property and to the group leaders for the maintenance of personal property.

5.2 Group Leaders

5.2.1 Group Leaders of organizations that have hazardous operations, as identified in the Facility Hazard Classification data base maintained by ESH-3, shall:

1. Apply the graded approach to the assigned personal property.

2. Develop equipment list for PP&PE in systems categorized as M1, M2, or M3.

3. Develop a maintenance program commensurate with the level of risk for the listed PP&PE.

5.2.2 Group leaders of organizations that have non-hazardous operations shall evaluate the potential mission impact of untimely equipment failures and implement a maintenance program if deemed appropriate.

5.2.3 Group Leaders of organizations that use only office equipment and personal computers shall not be required to develop a maintenance program since these items are categorically excluded from the requirements of this document.

5.3 Facility Managers-Facility managers shall:

1. Apply the graded approach to the assigned facilities and real property.

2. Develop equipment list for RP&IE in systems categorized as M1, M2, or M3.

3. Develop a maintenance program commensurate with the level of risk for the listed RP&IE.

6.0 Requirements

The requirements of this document are presented as five elements that shall form the core of an effective maintenance program. Each FMU and group, as

applicable, shall establish a maintenance program for the assigned facilities and equipment which encompasses these elements. The elements shall be:

6.1.1. Inventory and Grade

This element shall include:

- A survey of a facility and the application of the graded approach to identify systems that are important to public safety, worker safety, environmental protection and programmatic mission.

- The development of a system-based equipment list to serve as an inventory of what needs to be maintained.

6.1.2. Maintenance Procedures

This element shall include the determination of what maintenance activities, if any, are required to ensure reliable operation of the equipment inventoried as part of Element 6.1.1. The requirements shall be documented in maintenance procedures or in other safety or operating procedures.

6.1.3. Training and Qualification

This element shall include the evaluation of maintenance activities to identify the skills and knowledge necessary to perform these tasks, and the development of training and qualification programs. These training requirements shall be coordinated with the Laboratory Training Program. For nuclear facilities the maintenance training program shall be included in the facility Training Implementation Plan.

6.1.4. Scheduling

This element shall include the scheduling and performance of the maintenance activities identified in Element 6.1.2, in accordance with the frequency prescribed in the procedure.

6.1.5 Equipment / System Status

This element shall include the development and implementation of a system or process to readily and effectively communicate the current operational status of SSCs. The system or process shall communicate the current status of the SSC and clearly identify directly effected supporting systems and their status. This system or process shall be defined and incorporated into the responsible FM or Group Leaders Configuration Management Plan or other formalized process, and be utilized as an integral component of each facility work control processes.

A graded approach shall be utilized when determining SSCs requiring application of this element. At a minimum, ML1 and ML2 systems shall incorporate a system or process to communicate SSC status.

6.1.6. Equipment History

This element shall include the establishment and maintenance of a maintenance and repair history system to record scheduled maintenance, post maintenance test results, and repairs. History records shall be periodically reviewed to identify failure trends and evaluate the effectiveness of the maintenance program

6.2 Implementation Plan

The implementation plan is based on the five elements, and on Facility Hazard Classification, as identified in the Facility Hazard Classification data base maintained by ESH-3. Buildings in the High and Moderate Hazard Classification are first in the implementation plan, followed by Low Hazard Classification buildings, then Non-Hazard Classification buildings. The implementation plan with milestones is presented in Attachment 1. The milestones for Non-Hazard Classification building shall apply to those buildings selected by the Facility Manager based on importance to the mission or safety concerns that are below the threshold of the Low Hazard Classification. The facility specific Maintenance Implementation Plans for nuclear facilities shall identify detailed implementation milestones that meet or exceed the milestones presented in Attachment 9.1.

6.3 Graded Implementation Requirements

The graded approach shall indicate the level of rigor of maintenance applied to a structure, system, or component shall be commensurate with its importance to safety, security, and mission. Attachment 2 provides a matrix of the maintenance implementation elements and the categories of importance ML1 through ML4. The requirements for the maintenance of SSC assigned to the various categories of importance is presented in the matrix. To provide greater clarity, the implementation elements are divided into subelements in the matrix.

The matrix focuses on basic requirements. However, in those instances where an element is not required, it is not precluded. The model assumed for the maintenance of personal property is that the organization that operates the equipment is the organization that maintains the equipment. In this model, elements such as work order system, priority system, or formal job planning may add little value and are not required. However in those situations where other organizations (groups or contractors) perform equipment maintenance, elements such as work order system, priority system, etc., could be very helpful, and shall be used where appropriate.

For those situations where a maintenance management element is not required, the group responsible for maintenance shall evaluate the benefits of incorporating the element and determine the level of rigor most appropriate for each situation. While a Work Request system is not required for PP&PE, it may be very valuable in those situations where PP&PE is OSR/TSR or Safety Related equipment.

7.0 Documentation

Each of the five maintenance program elements shall be documented. The required documentation includes master equipment list, requirements for preventive maintenance, maintenance procedures, training requirements, and equipment history. The master equipment list shall be developed and graded following the guidance of LIG 230-09-01. Maintenance procedures including training requirements shall be developed in accordance with LIG 230-06-01. Equipment history shall include records of all maintenance and repair as well as post maintenance test result where appropriate. Documentation of the scheduling process shall be addressed in the work control process.

8.0 References

8.1 Document Ownership

The office of institutional coordination (OIC) for this document shall be the Institutional Facility Management Program Office within FE Division.

8.2 Referrals

ESH-3 for information on Facility Hazard Classification.

IFMPO for information concerning MIP preparation, implementation plan and associated documentation, and use of the graded approach.

FSS-9 for information concerning the technical content of the MEL, required equipment maintenance activities, and equipment history functions.

8.3 Documents

DOE Order 4330.4B, Maintenance Management Program, Chapter II
LPR230-01-00, Managing Facility Assets
LPR230-02-00, Facility Condition and Inspections
LPR230-03-00, Maintenance Work Control
LPR230-04-00, Conduct of Maintenance
LPR230-05-00, Preventive Maintenance
LPR230-06-00, Maintenance Procedures and Documentation
LPR230-07-00, Maintenance History
LPR230-09-00, Inventory and Categorization of Facilities
LIG230-09-01, Developing a Graded Master Equipment List
LIG230-06-01, Maintenance Procedures, Training, Scheduling, and History

9.0 Attachments

A **Recommend Major Criteria for Self-Assessment**

9.1 **Milestones for Implementation of Maintenance program**

9.2 **Graded Approach to the Conduct of Maintenance**

Guidance

Attachment A
Recommended Major Implementation Criteria for Self-Assessment
(Non-Mandatory)

6.1.6.1 LIR Title LIR Number

Laboratory Maintenance Management Program **LIR 230-04-01**

7 The Major implementation criteria listed below are provided to assist Laboratory

Organizations in assessing their implementation of this LIR. These criteria provide an objective basis for self-assessing implementation of the major requirements contained in the LIR. The LIR also states requirements in other areas, such as, scope, precautions, and responsibilities that, when applied, complement the successful implementation of these major requirements.

1. The most important criterion for assessing the implementation status of this LIR should be, if applicable: Have the requirements contained in the LIR been communicated to the individual(s) responsible for performing the work?

2. In addition, the recommended major implementation criteria for self-assessment of this LIR are the following:

- **Inventory and Grade**

6.1.6 Review evidence of the facility survey results and equipment grading. Has a Master Equipment List been developed and maintained to provide the basis for the maintenance program? Do the results accurately reflect the description of the facility and indicate the Management Level (ML) for each SSC identified in the survey. Are the MEL data elements complete and accurate?

- **Maintenance Procedures**
  Review the Institutional and facility-specific maintenance procedures. Are the required procedures in place and controlled? Review the procedures to determine if they include the determination of what maintenance activities, if any, are required to ensure reliable operation of the equipment inventoried as part of Element 6.1.1.

- **Training and Qualification**
  Are the training requirements defined and documented? Are the training plans approved, in place and coordinated with the Laboratory Training Office? Do the

maintenance workers understand their training requirements and are they current with the requirements documented in the training plans? Is documentation readily available indicating that they are authorized to perform work based on the currency of their individual training plans?

- **Scheduling**
  Review the Facility maintenance schedule and compare the documented schedule to the work assignments communicated during the Plan-of-the-day or other meeting where the work assignments are made. The schedule should reflect a hard schedule for the work to be performed on the day of the assessment and contain a "look-ahead" for all known maintenance activities.

- **Equipment History**
  Review maintenance history files for accuracy and completeness. All facility related work generated through the work control process should capture the history of the maintenance evolutions indicated in the scope of the work control document(s) and detail the information required for managers to assess the general health of the SSCs under review and management. The history data should be capable of providing maintenance trend analysis associated with any component contained in the MEL.

- **Implementation Plan**
  Review the facility specific Maintenance Implementation Plan (MIP). The MIP describes the approach for the facility maintenance program. To determine if the plan adequately describes the program, evaluate the following criteria: Is the MIP known and understood by the maintenance managers for the facility? Does the MIP address the required five elements. Is the MIP approved?

- **Graded Implementation Requirements**
  Review the facility master equipment list (MEL). Have Maintenance Levels been determined and assigned to all SSCs contained in the facility Master Equipment List. Is there evidence and documentation describing how the ML determinations were made?

Milestones for Implementation of Maintenance Program	
For High- and Medium-Hazard Classification Buildings	
• Facility Managers and leaders of groups occupying high and medium hazard classification buildings shall apply the graded approach and identify Category 1, 2, and 3 systems within their buildings.	1/95 Completed
• The Facility Managers and leaders of groups occupying high and medium hazard classification buildings shall develop equipment lists of the Category 1 and 2 real and personal property systems.	6/95 Completed
• Facility Managers and leaders of groups occupying high and medium hazard classification facilities shall develop maintenance procedures for Category 1 and 2 plant and programmatic equipment, respectively.	6/96 Completed
• Facility Managers and leaders of groups occupying high and medium hazard classification buildings shall evaluate the need for special skills and knowledge and establish training and qualification programs as appropriate for the maintenance of Category 1 and 2 equipment.	10/96 Completed
• Facility Managers and leaders of groups occupying high and medium hazard classification buildings shall develop scheduling capability for the maintenance activities required for Category 1 and 2 plant and programmatic equipment, respectively.	12/96 Completed
• Facility Managers and leaders of groups occupying high and medium hazard classification buildings shall develop equipment history systems for Category 1 and 2 plant and programmatic equipment, respectively.	6/97 Completed
For Low-Hazard Classification Buildings	
• Facility Managers and leaders of groups occupying low-hazard classification buildings shall apply graded approach and identify Category 2 and 3 systems within their buildings.	1/96 Completed
• The Facility Managers and leaders of groups occupying low-hazard classification buildings shall develop equipment lists of the Category 2 real and personal property systems.	6/96 Completed

	• Facility Managers and leaders of groups occupying low-hazard classification buildings shall develop maintenance procedures for Category 2 plant and programmatic equipment, respectively.	6/97 Completed
	• Facility Managers and leaders of groups occupying low-hazard classification buildings shall evaluate the need for special skills and knowledge and shall establish training and qualification programs as appropriate for the maintenance of Category 2 equipment.	10/97 Completed
	• Facility Managers and leaders of groups occupying low-hazard classification buildings shall develop scheduling capability for the maintenance activities required for Category 2 plant and programmatic equipment, respectively.	12/97 Completed
	• Facility Managers and leaders of groups occupying low-hazard classification buildings shall develop equipment history systems for Category 2 plant and programmatic equipment, respectively.	6/98
7.3	For Category 3 Equipment in High-, Medium-, and Low-Hazard Classification Buildings	
	• The Facility Managers and leaders of groups occupying high, medium and low hazard classification buildings shall develop equipment lists of the Category 3 personal property systems.	9/96 Completed
	• Facility Managers and leaders of groups occupying high, medium and low hazard classification buildings shall develop maintenance procedures as appropriate for Category 3 plant and programmatic equipment, respectively.	1/98 Completed
	• Facility Managers and leaders of groups occupying high, medium and low hazard classification buildings shall evaluate the need for special skills and knowledge and shall establish training and qualification programs as appropriate for the maintenance of Category 3 equipment.	3/98
	• Facility Managers and leaders of groups occupying high, medium and low hazard classification buildings shall develop scheduling capability for the maintenance activities required for Category 3 plant and programmatic equipment, respectively.	5/98

• Facility Managers and leaders of groups occupying high, medium and low hazard classification buildings shall develop equipment history systems for Category 3 programmatic and plant equipment, respectively.	6/98
For Selected Nonhazard Classification Buildings	
• Facility Managers and leaders of groups occupying nonhazard classification buildings shall develop graded equipment lists.	6/97 Completed
• Facility Managers and leaders of groups occupying nonhazard classification buildings shall develop maintenance procedures as appropriate for Category 2 and 3 plant and programmatic equipment, respectively	12/97 Completed
• Facility Managers and leaders of groups occupying nonhazard classification buildings shall evaluate the need for special skills and knowledge and shall establish training and qualification programs as appropriate for the maintenance of Category 2 and 3 equipment for maintenance of plant equipment.	3/98
• Facility Managers and leaders of groups occupying nonhazard classification buildings shall develop scheduling capability and equipment history systems for Category 2 and 3 plant and programmatic equipment, respectively.	6/98

GRADED APPROACH TO THE CONDUCT OF MAINTENANCE

RP=Real Property and Installed Equipment, formerly Class "A"
PP=Personal Property and Programmatic Equipment, formerly Class "B"
"Shall" implies requirement. "May" implies an option.

Inventory & Grade	ML1	ML2	ML3	ML4
Organization & Staffing	RP&PP - Responsibility shall be assigned and documented	RP&PP - Responsibility shall be assigned and documented	RP&PP - Responsibility shall be assigned and documented	RP&PP - Responsibility shall be assigned
Administration	RP - Administrative procedures shall address work control, scheduling, performance standards, documentation requirements, and assessments. PP - Follow Laboratory maintenance management guidance.	RP - Administrative procedures shall address work control, scheduling, performance standards, documentation requirements, and assessments. PP - Follow Laboratory maintenance management guidance.	RP - Administrative procedures shall address work control, scheduling, performance standards, documentation requirements, and assessments. PP - Follow Laboratory maintenance management guidance.	RP - Administrative procedures shall address work control, scheduling, performance standards, documentation requirements, and assessments. PP - Follow Laboratory maintenance management guidance.
Work Request System	RP - Shall be required PP - Not required, but may be of value.	RP - Shall be required PP - Not required, but may be of value.	RP - Shall be required PP - Not required, but may be of value.	RP - Shall be required PP - Not required, but may be of value.
Modifications and Additions	RP&PP - A process shall be required to inventory and grade future modifications and system additions.	RP&PP - A process shall be required to inventory and grade future modifications and system additions.	RP&PP - A process shall be required to inventory and grade future modifications and system additions.	RP&PP - Inventory is not required, but may be of value.

Maintenance Procedures	**ML1**	**ML2**	**ML3**	**ML4**
Maintenance Procedures & Other Work Related Documents	RP &PP - Procedures are required and shall be detailed and equipment specific and include requirements for special tools, calibrated M&TE, parts, equipment, permits and coordination with other organizations.	RP &PP - Procedures are required but may be generic if required equipment specific information that includes unique requirements for special tools, calibrated M&TE, parts, equipment, permits, & coordination with other organizations is provided.	RP &PP - The responsible organization shall determine the need for procedures based on equipment complexity, workers skills. etc.	RP & PP - Procedures are not required, but may be of value.
Post Maintenance Testing	RP&PP - Requirement for post maintenance testing shall be included in procedure and test results shall be documented.	RP&PP - Requirement for post maintenance testing shall be included in the procedure and results shall be documented.	RP&PP - Requirement for post maintenance testing and results documentation shall be established by the responsible supervisor.	RP&PP - Post maintenance testing not required, but may be of value.
Preventive Maintenance	RP&PP - Preventive maintenance requirements shall be based on assuring the highest reasonable level of reliability to reduce risk to the public and shall be documented	RP&PP - Preventive maintenance requirements shall be based on assuring a reasonable level of reliability to promote worker safety and shall be documented	RP&PP - Economic considerations shall be the basis for determining preventive maintenance requirements and frequencies shall be documented.	RP&PP - Preventive maintenance not required, but may be of value.
Predictive Maintenance	RP&PP - The determination to utilize predictive maintenance shall be based on risk reduction and enhanced safety and the application shall be documented.	RP&PP - The determination to utilize predictive maintenance shall be based on risk reduction and enhanced safety and the application shall be documented.	RP&PP - The determination to utilize predictive maintenance shall be based on risk reduction and enhanced safety and the application shall be documented.	RP&PP - Consideration of predictive maintenance is not required.

Scheduling	**ML1**	**ML2**	**ML3**	**ML4**
Scheduling System	RP - Detailed scheduling following a documented process shall be required. PP - Scheduling capability shall be required, but may be triggered by use.	RP - Detailed scheduling following a documented process shall be required. PP - Scheduling capability shall be required, but may be triggered by use.	RP - Scheduling shall be required to ensure proper craft sequence and outage coordination. PP - Scheduling capability shall be required, but may be triggered by use.	RP&PP - Scheduling shall be required when outages or other coordination is required.
Work Order Priority System	RP - A documented priority system based on the graded approach shall be required. PP - A priority system is not required, but may be of value.	RP - A documented priority system based on the graded approach shall be required. PP - A priority system is not required, but may be of value.	RP - A documented priority system based on the graded approach shall be required. PP - A priority system is not required, but may be of value.	RP - A documented priority system based on the graded approach shall be required. PP - A priority system is not required, but may be of value.
Formal Job Planning and Estimating	RP - Formal job planning shall be required, and estimating as necessary for scheduling. PP - Formal job planning and estimating is not required, but may be of value.	RP - Formal job planning shall be required, and estimating as necessary for scheduling. PP - Formal job planning and estimating is not required, but may be of value.	RP - Job Complexity and cost benefit shall be considered in determining need for job planning and estimating. PP - Not required, but may be of value.	RP - Job Complexity and cost benefit shall be considered in determining need for job planning and estimating. PP - Not required, but may be of value.
Backlog Work Control	RP - Work order and priority systems shall be used to control backlog. PP - Repairs shall be completed in a timely manner.	RP - Work order and priority systems shall be used to control backlog. PP - Repairs shall be completed in a timely manner.	RP - Work order and priority systems shall be used to control backlog. PP - Repairs shall be completed in a timely manner.	RP - Work order and priority systems shall be used to control backlog. PP - Repairs shall be completed in a timely manner.

Corrective Maintenance	RP&PP - A system shall be required to ensure that repairs are completed in a timely manner.	RP&PP - A system shall be required to ensure that repairs are completed in a timely manner.	RP&PP - A system shall be required to ensure that repairs are completed in a timely manner.	RP&PP - A system shall be required to ensure that repairs are completed in a timely manner.
On Hand Spare Parts	RP&PP - The determination of the need for on-hand spares shall be based on lead time and repair urgency. If needed, a control system shall be required.	RP&PP - The determination of the need for on-hand spares shall be based on lead time and repair urgency. If needed, a control system shall be required.	RP&PP - The determination of the need for on-hand spares shall be based on lead time and repair urgency. If needed, a control system shall be required.	RP&PP - Consideration of on-hand spare parts is not required, but may be of value.
Training and Qualification	**ML1**	**ML2**	**ML3**	**ML4**
Training and Qualification	RP&PP - Training and or Qualification requirements shall be determined by line management and identified in maintenance procedures, and personnel shall be trained to the procedures.	RP&PP - Training and or Qualification requirements shall be determined by line management and identified in maintenance procedures, and personnel shall be trained to the procedures.	RP&PP - Training requirements shall be based on considerations of system complexity, site access requirements, and basic skills of assigned maintenance personnel.	RP&PP - Qualification beyond basic skills of assigned maintenance personnel and site access needs is not required, but training may be of value.

Repair History	**ML1**	**ML2**	**ML3**	**ML4**
Equipment Repair History and Vendor Information	RP&PP - Complete equipment history shall be required, including work accomplished, parts used, worker's name, date, time to complete, and post maintenance test results and a system to ensure availability of vendor information.	RP&PP - Complete equipment history shall be required, including work accomplished, parts used, worker's name, date, time to complete, and post maintenance test results and a system to ensure availability of vendor information.	RP - Equipment history shall be required, generally the same as M1 and M2, with the exception of post maintenance test results. PP - Work completion data required	RP - work Completion data shall be required. PP - Not required, but may be of value.
Analysis of Root Causes of Problems	RP&PP - Failure analysis and documentation of results shall be required.	RP&PP - Operating personnel determine need for and formality of failure analysis.	RP&PP - Operating personnel determine need for and formality of failure analysis.	RP&PP - Formal failure analysis not required.
Performance Measurement	RP -Performance measures shall be developed and trended to measure effectiveness of program. PP - Effectiveness of program may be measured by productivity of process.	RP -Performance measures shall be developed and trended to measure effectiveness of program. PP - Effectiveness of program may be measured by productivity of process.	RP -Performance measures shall be developed and trended to measure effectiveness of program. PP - Effectiveness of program may be measured by productivity of process.	RP&PP - Performance measures are not required, but may be of value.